Earth System Dynamics Discussions

Earth Syst. Dynam. Discuss., referee comment RC1
https://doi.org/10.5194/esd-2021-94-RC1, 2021

Comment on esd-2021-94

Anonymous Referee #1

Referee comment on "Glacial runoff buffers droughts through the 21st century" by Lizz Ultee et al., Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2021-94-RC1, 2021

In the context of future climate change, to quantitatively analyze the effects of glacial runoff on droughts is of great significance. The topic of this manuscript is important; however, this manuscript, in its present form, still contains several weaknesses. My major concerns are as follows:
First, there is a lack of recent references (NONE published in 2021). This manuscript will be less persuasive without a comprehensive literature review. I would suggest the authors review and cite more relevant papers.
Second, the authors use SPEI (rather than SPI) as an indicator of drought considering runoff. Although they have stated in Appendix C that "SRI has a moderate to strong positive correlation with SPEI", the median correlation is only approximately 0.5, which is not high. I would suggest the authors further discuss the influences of using SPEI on the results. Otherwise, the conclusions are not reliable enough.
Third, a big problem of this manuscript is that it does not take into account the CO2 emissions during the processes of melting glaciers. If just considering melting glaciers as the water source of runoff but ignoring the fact that it is also the emission source of greenhouse gas, the whole conclusion will be embellished. The authors should pay attention to this issue.
Fourth, the authors are encouraged to further compare the results under the RCP 4.5 scenario against those under the RCP 8.5 scenario, although there are some relevant sentences in Lines 222-232. The potential findings may provide a reference for better policy making of drought mitigation.
Some specific comments:
1. The authors are encouraged to summarize the innovation/major contributions of this study in the last paragraph of the Introduction part.
2. Eight GCMs are used in this study. Which eight GCMs? The authors do not mention them in the text. Please clarify this clearly.
3. Lines 86-87: "… we use a relatively short 3-month integration timescale, which is typical of that used to assess streamflow drought." Any references for this statement?
4. As mentioned in Line 243, "current glacier meltwater production is unsustainably high". I would suggest the authors discuss more about the possible results under such situation.
5. Appendix A: the authors only show the results for all the 56 basins in Figure A1, but do not provide in-depth discussions/explanations. For example, for some basins, blue shades and orange shades are overlapped; for others, blue shades and orange shades are not overlapped. Is it consistent with the result of K-means cluster analysis? Moreover, it is better to provide sufficient physical interpretations.